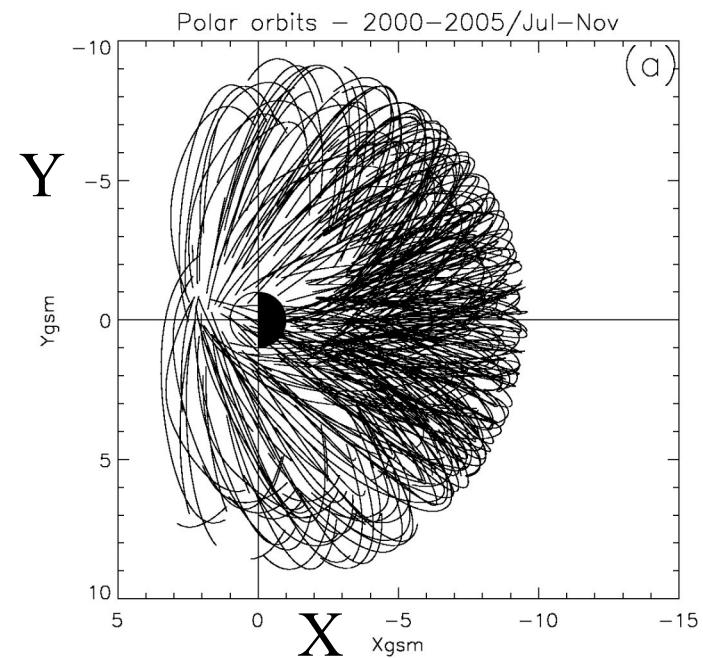
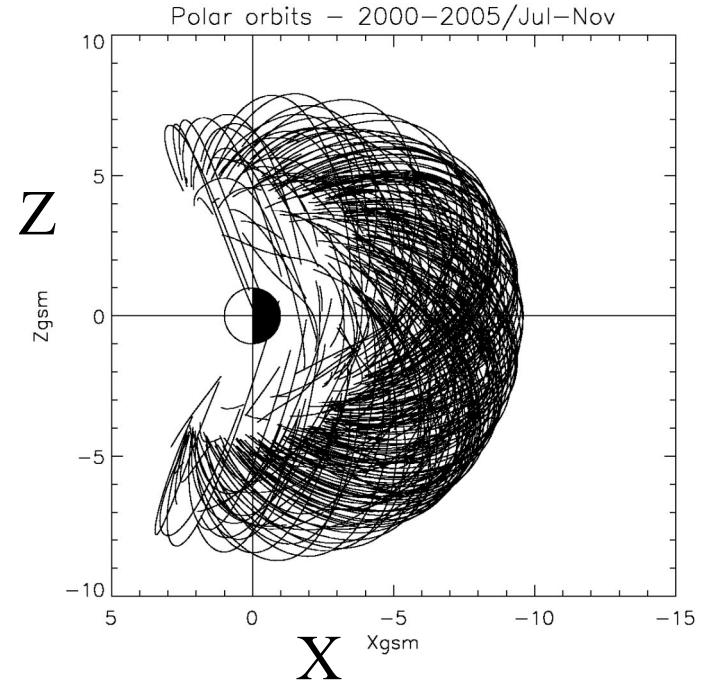
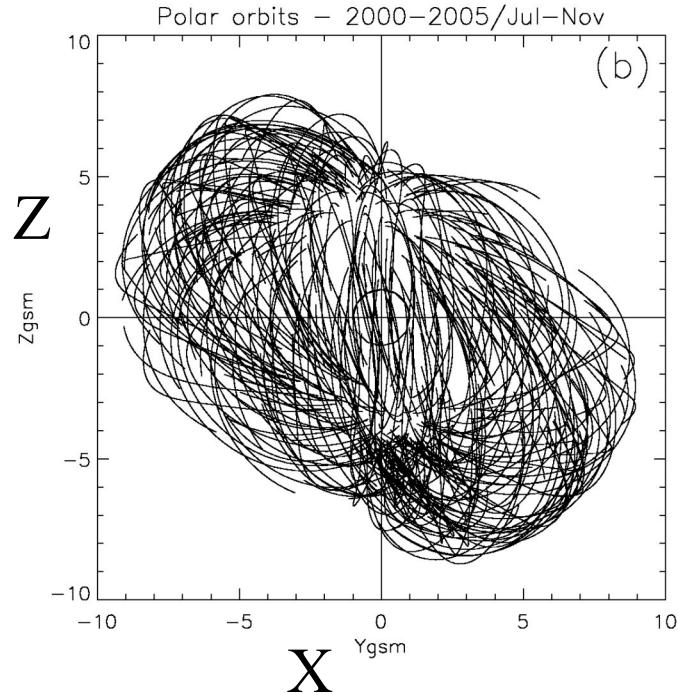


# Geospace Storms and Thermal Ions in the Near-Earth Magnetotail

Chen, S, [schen@gsfc.nasa.gov](mailto:schen@gsfc.nasa.gov), Universities Space Research Association, NASA/GSFC  
Moore, T E, [thomas.e.moore@nasa.gov](mailto:thomas.e.moore@nasa.gov), Heliospheric Physics Branch, NASA/GSFC

## Outline:

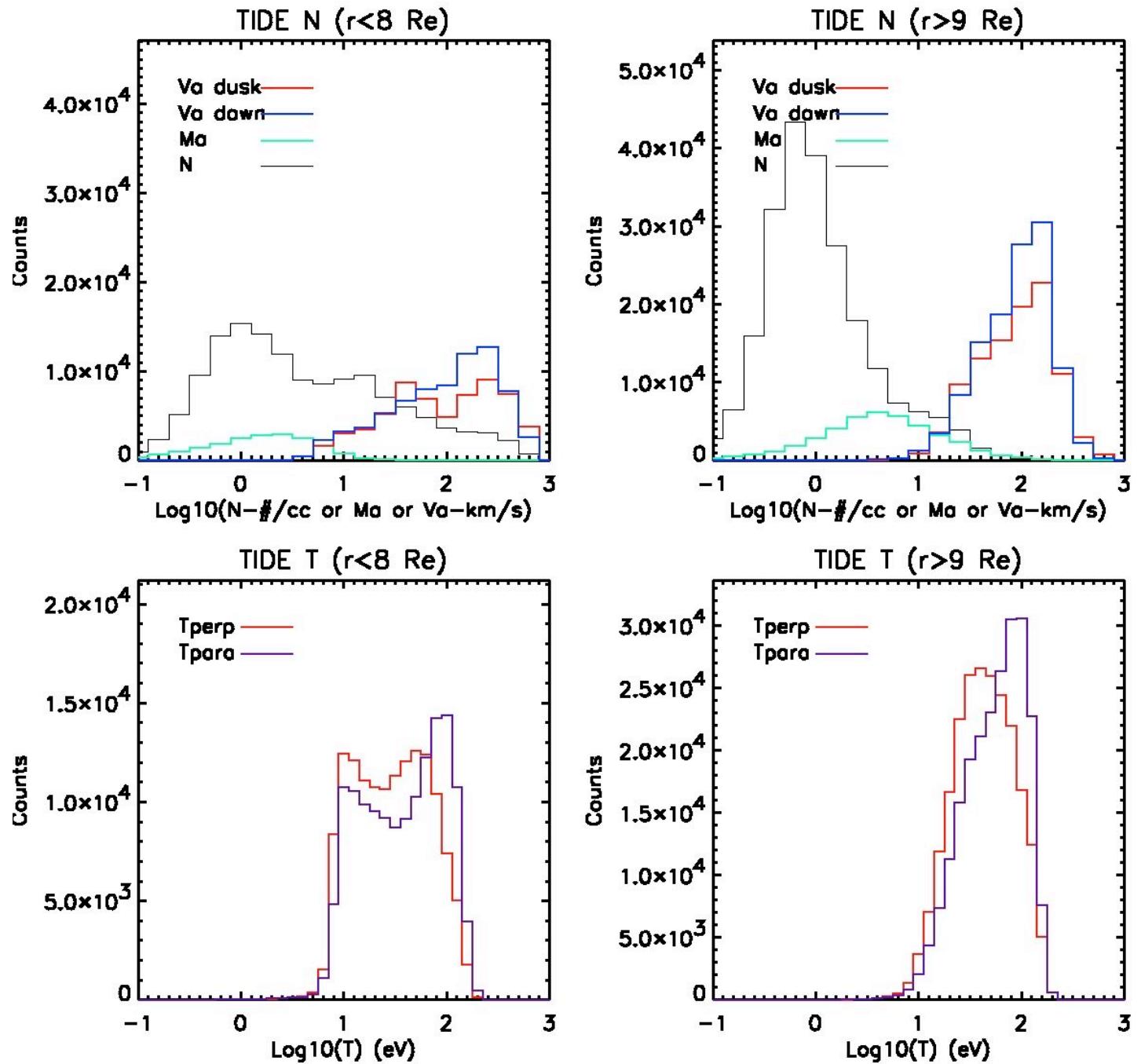
- Near-Earth magnetotail during geomagnetic activity
- Polar/TIDE, /MFE measurements 2000 to 2005
- Plasma properties of < 450 eV ions, distances 5 to 10 R<sub>E</sub>
- Solar wind conditions and geomagnetic indices:
  - ACE solar wind plasma and **B**
  - AE, K<sub>p</sub> and Dst indices
- Tsyganenko field model maps to ionospheric altitudes, nightside auroral ovals
- Statistical analyses of the spatial distributions
- Relationships to solar wind drivers and geomagnetic indices



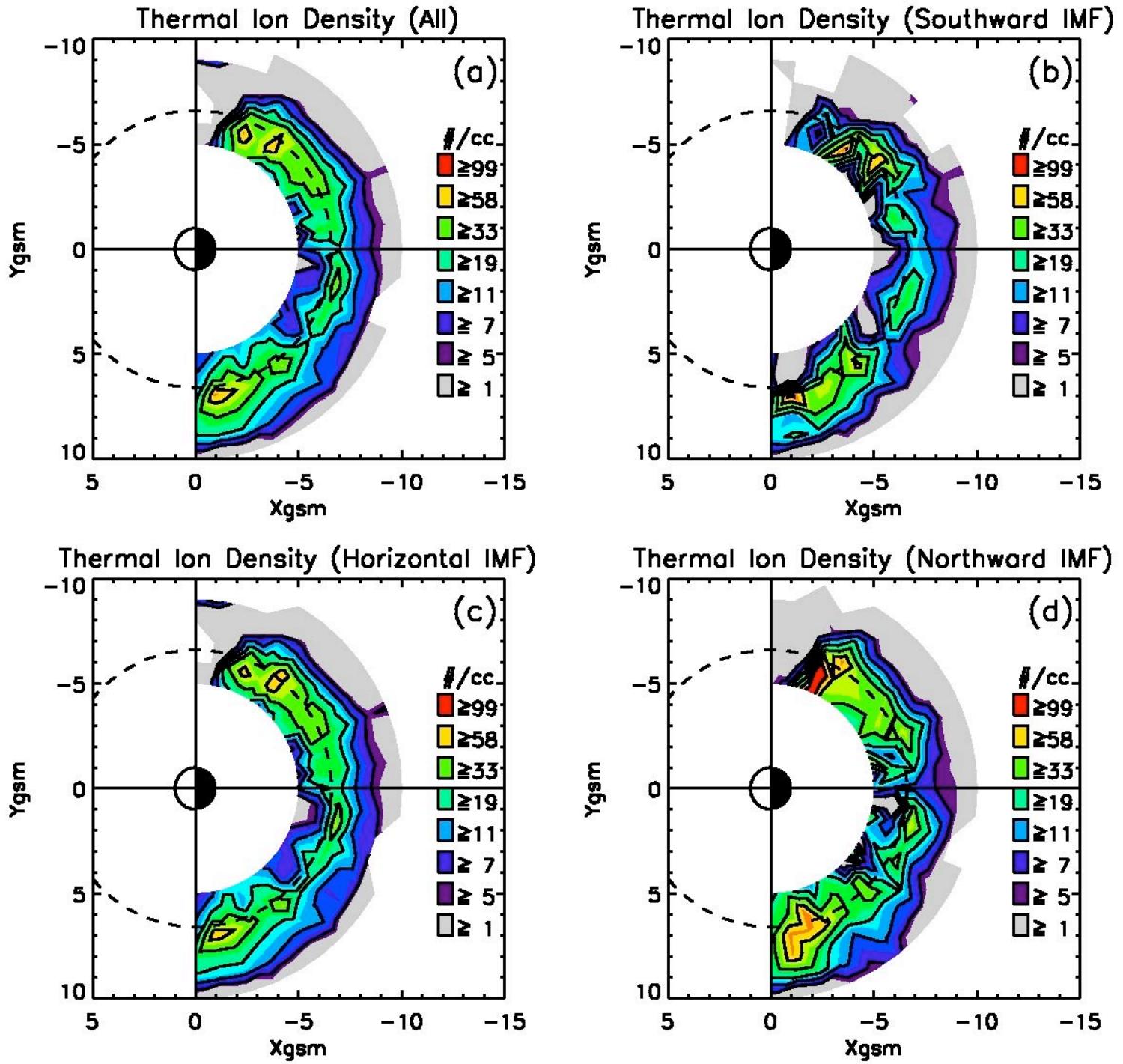
## The Database of Samples:

Six years of night-side Polar orbits between 2000 and 2005.  
Only every 5th orbit is plotted.

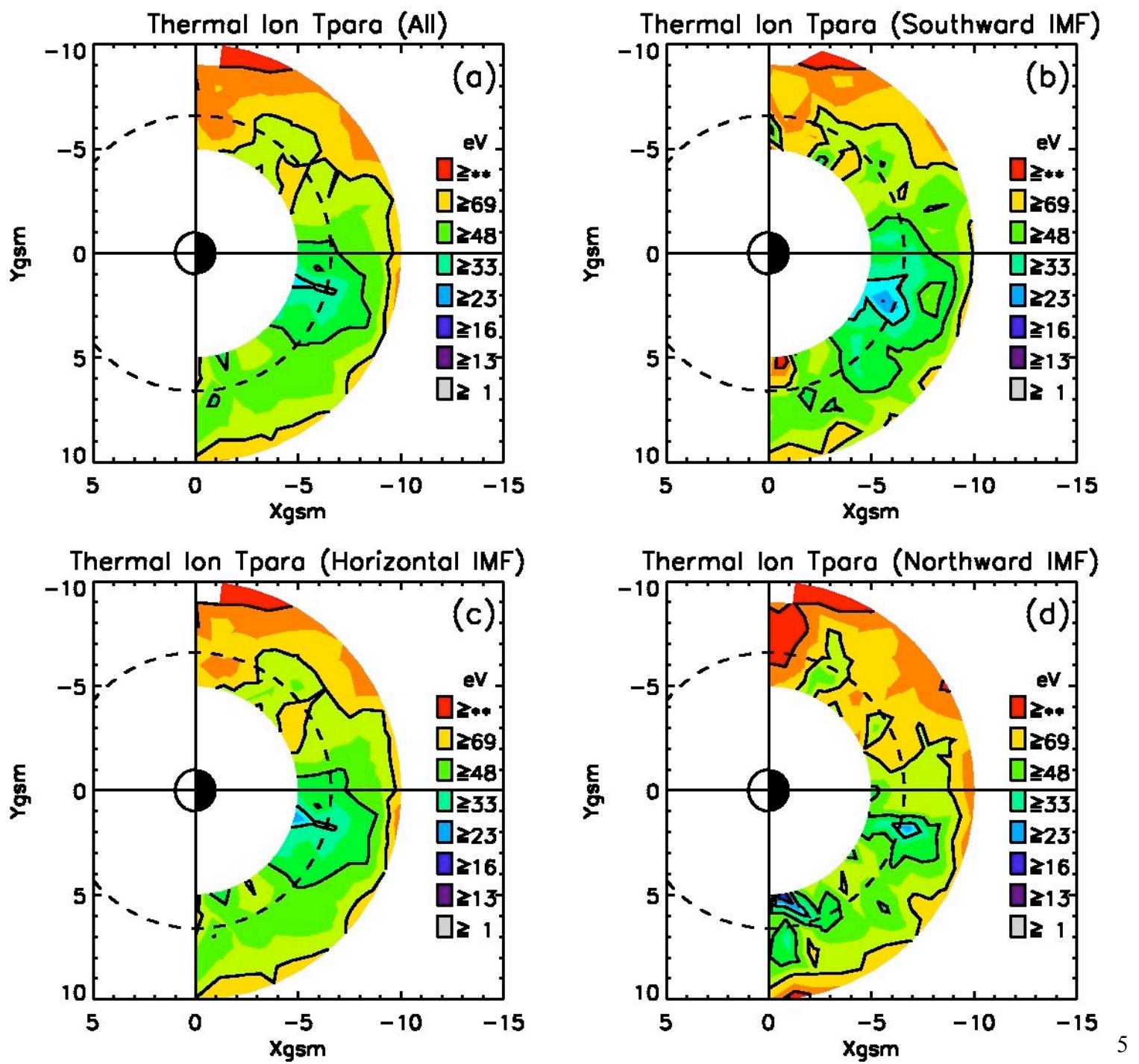
Histograms  
of N, Ma,  
Va, Tpara,  
Tperp at the  
inner and  
outer parts of  
the dawn and  
dusk sectors



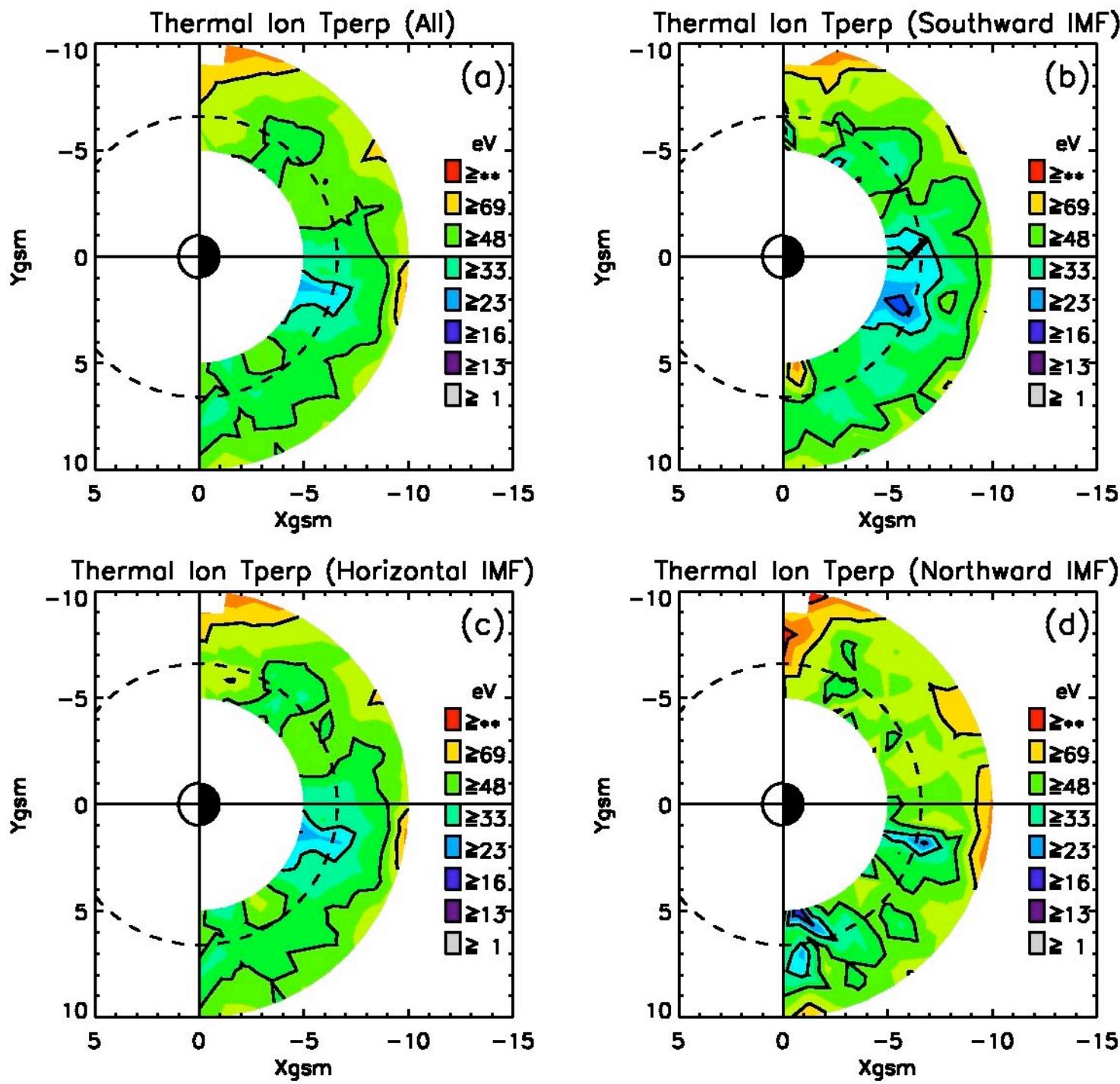
EQ  
Density  
VS  
IMF



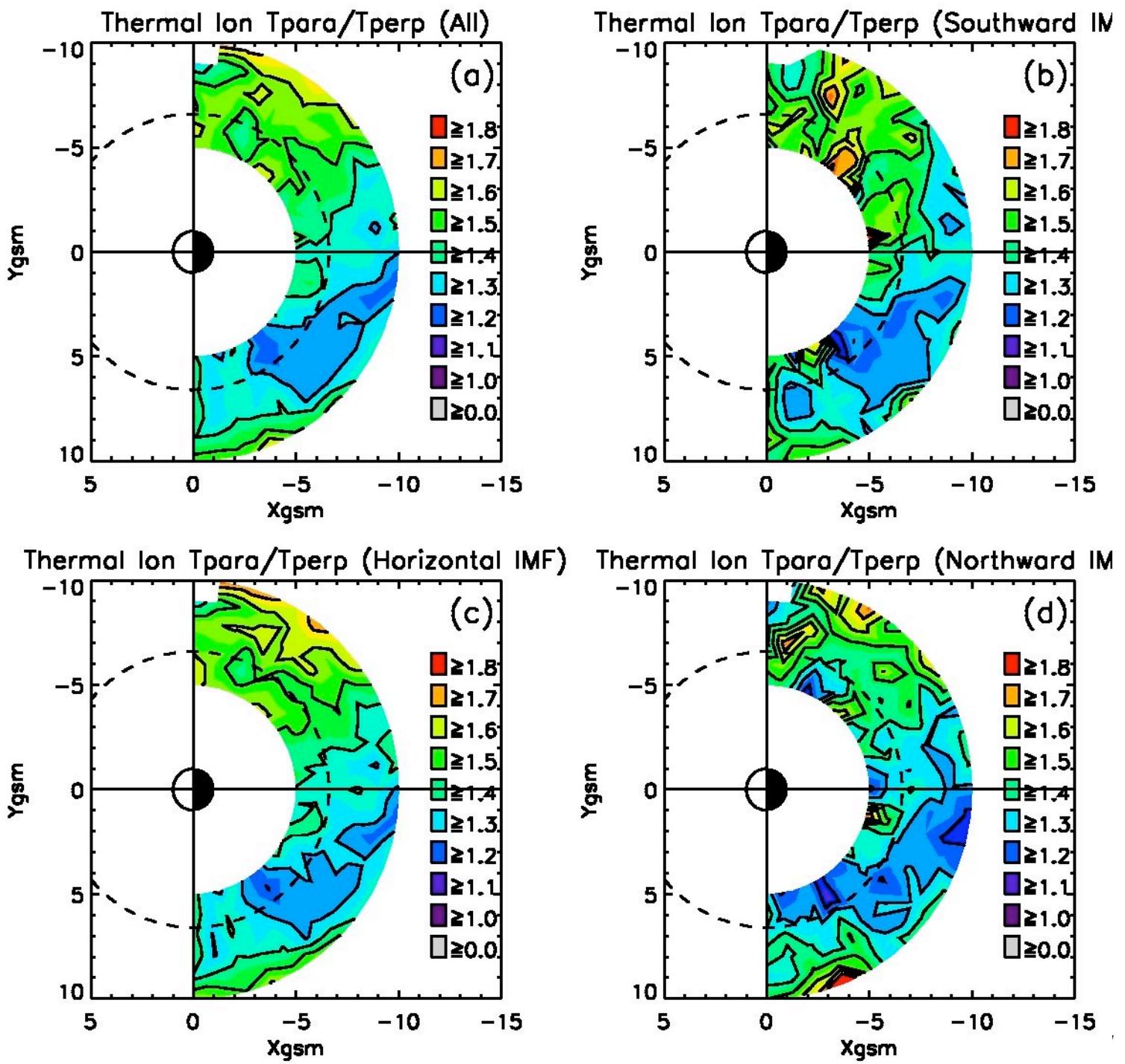
EQ  
Tpara  
vs  
IMF



EQ  
Tperp  
vs  
IMF



EQ  
Tpara/  
Tperp  
vs  
IMF



# Definition of Bidirectional Flow Ratio

*Bluish* : anti-parallel uni-dir

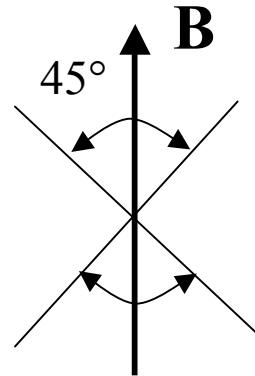
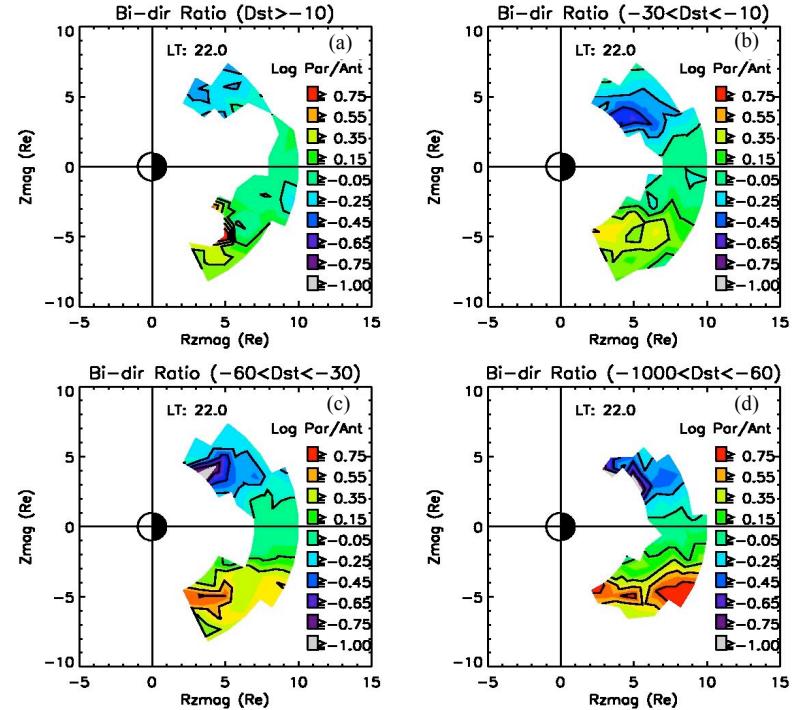
*Greenish* : bi-directional

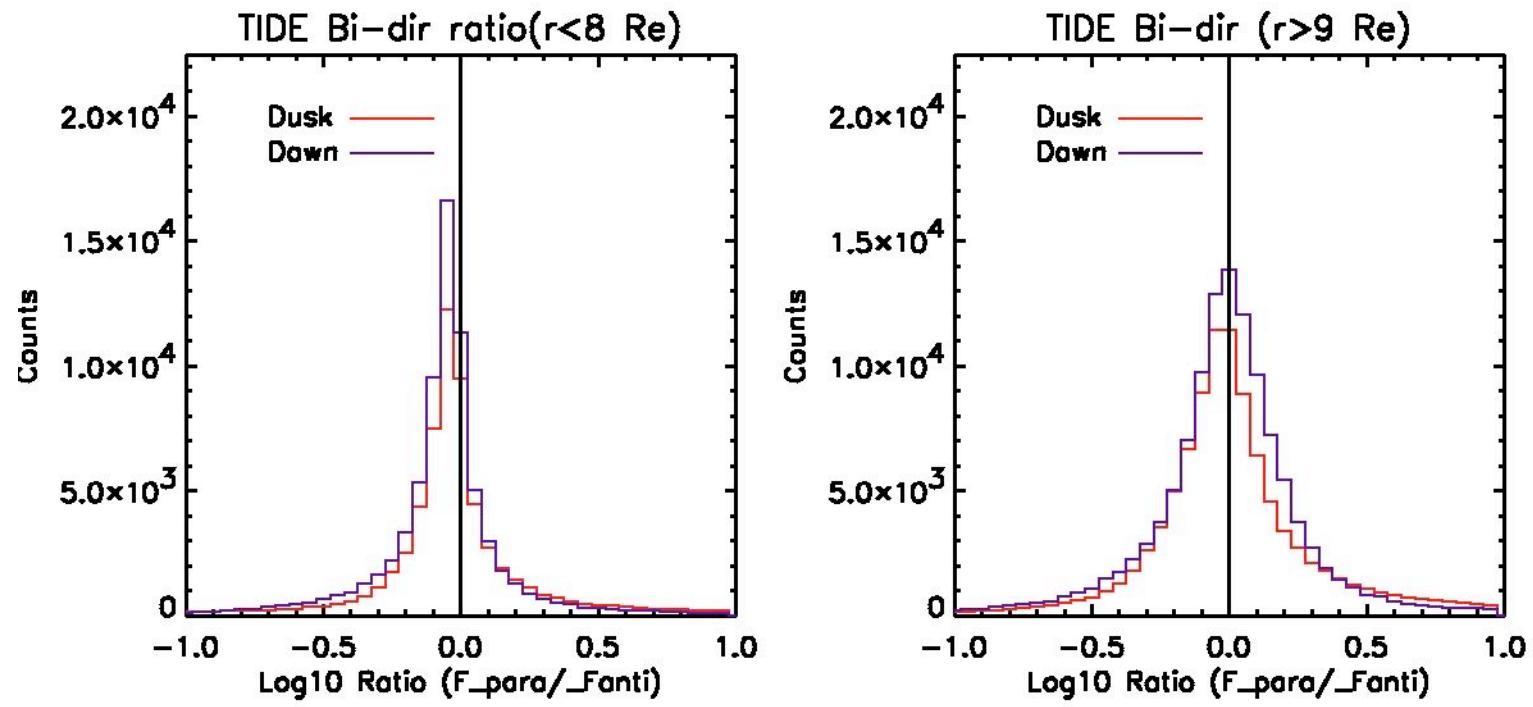
*Reddish* : parallel uni-dir

$$R_{bidir} = \frac{P_{para}}{P_{anti}}$$

$$P_{para} = G_{v_\theta} \sum_{v_\phi}^{-45 < \phi < 45} \sum_{v_r} (v_r - V_r) (v_\phi - V_\phi) f(v) \Delta v_r \Delta v_\phi$$

$$P_{anti} = G_{v_\theta} \sum_{v_\phi}^{135 < \phi, \phi < -135} \sum_{v_r} (v_r - V_r) (v_\phi - V_\phi) f(v) \Delta v_r \Delta v_\phi$$

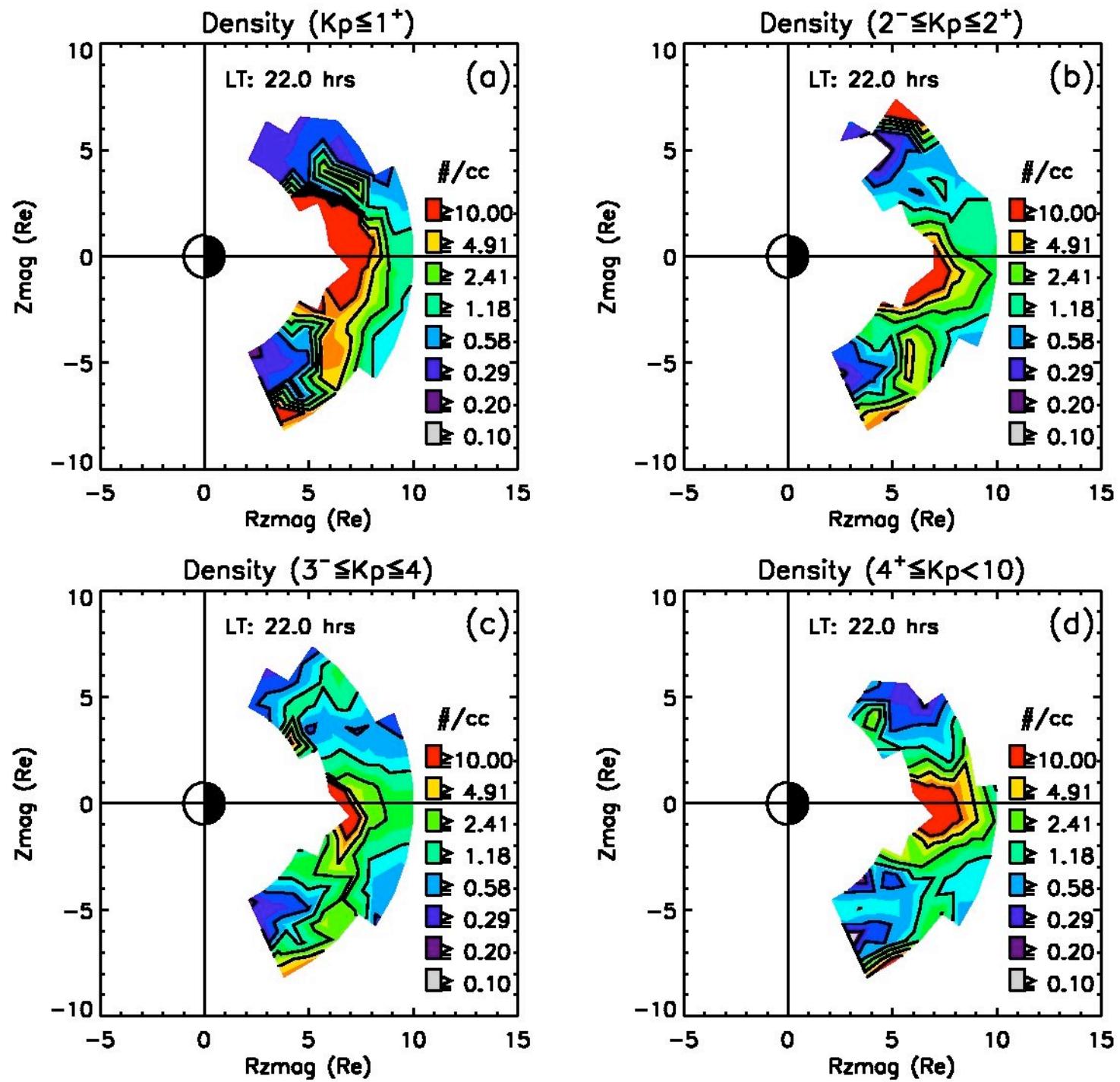




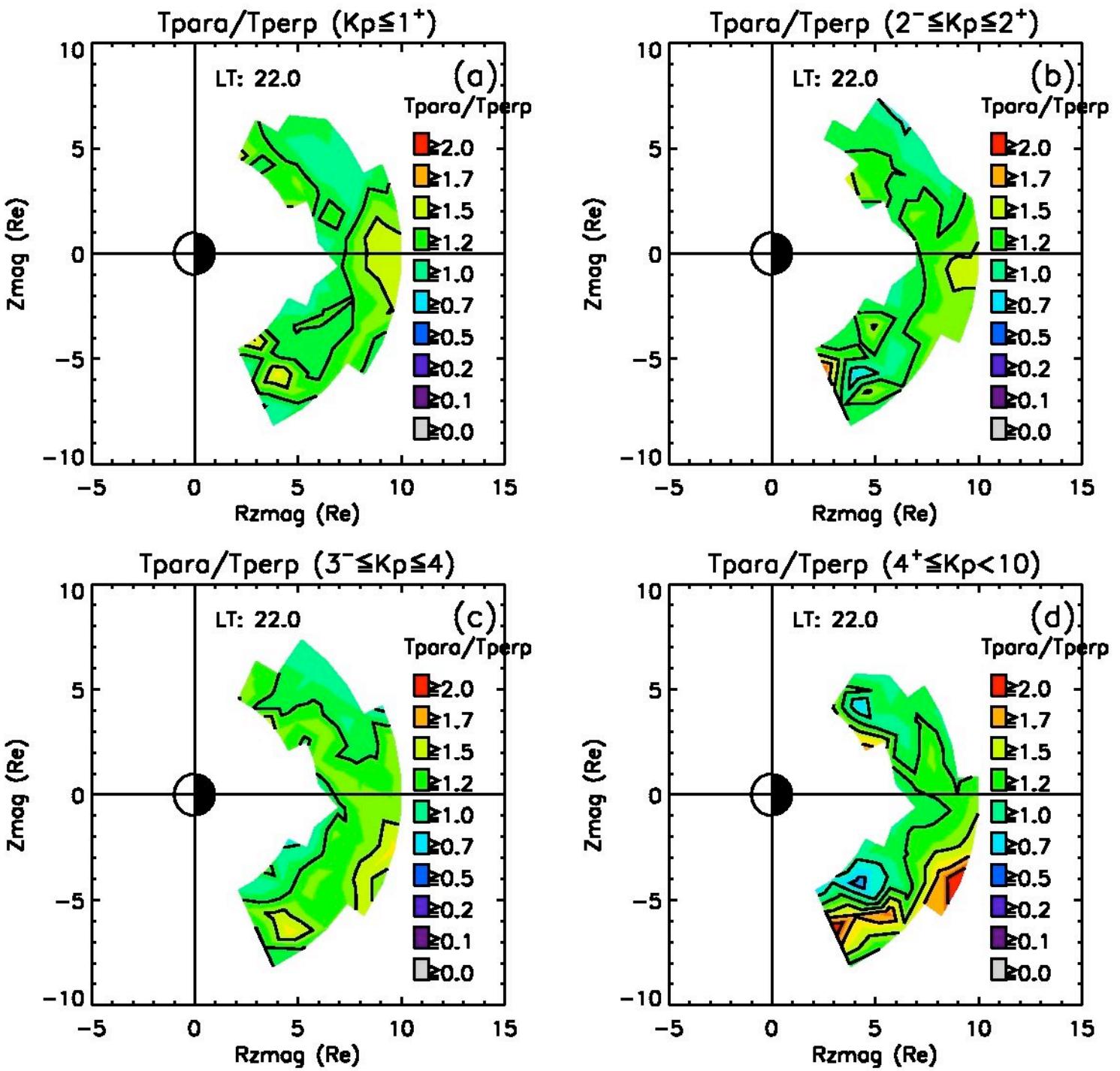
Histograms of the bi-dir ratio at the inner and outer parts of the dawn and dusk sectors.

N, T, Bi-dir  
Kp – LT22

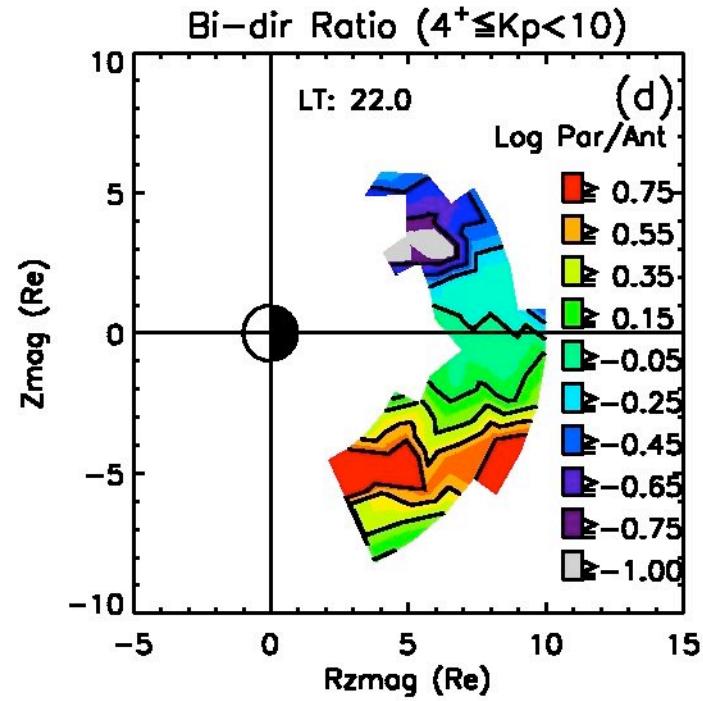
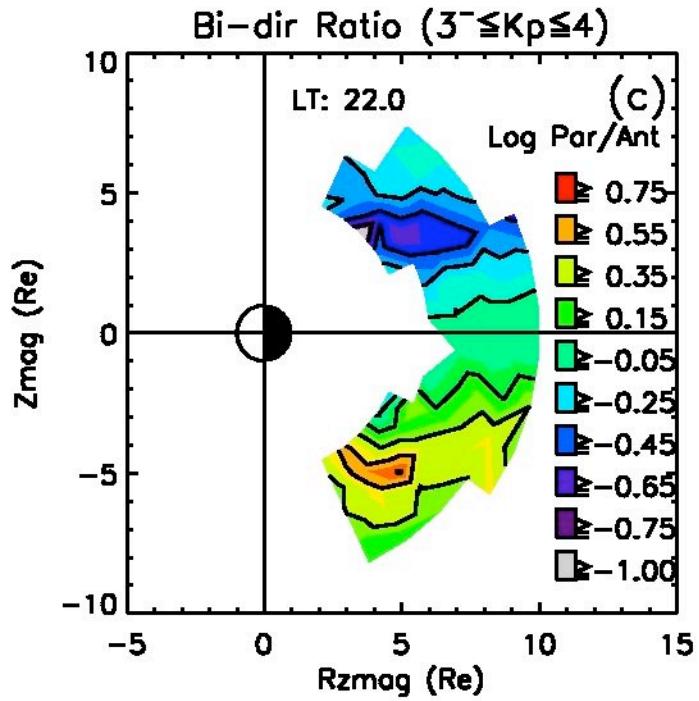
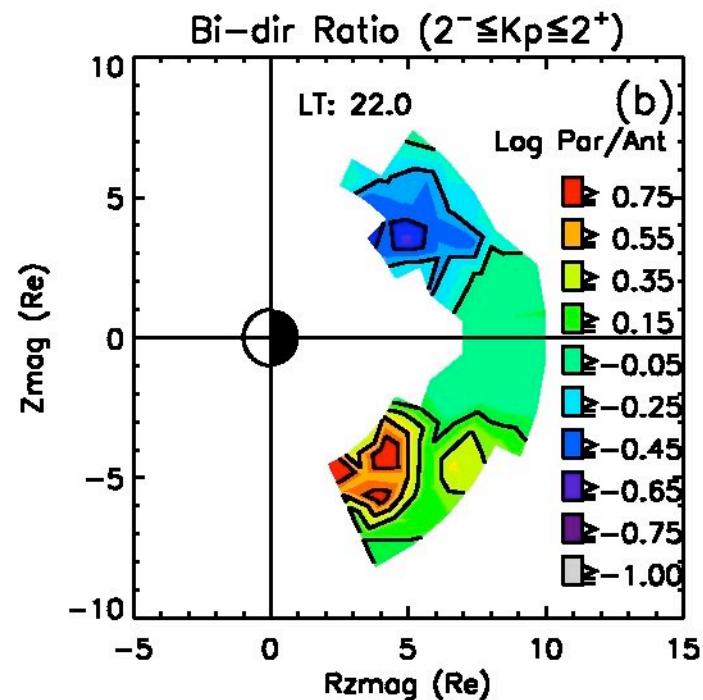
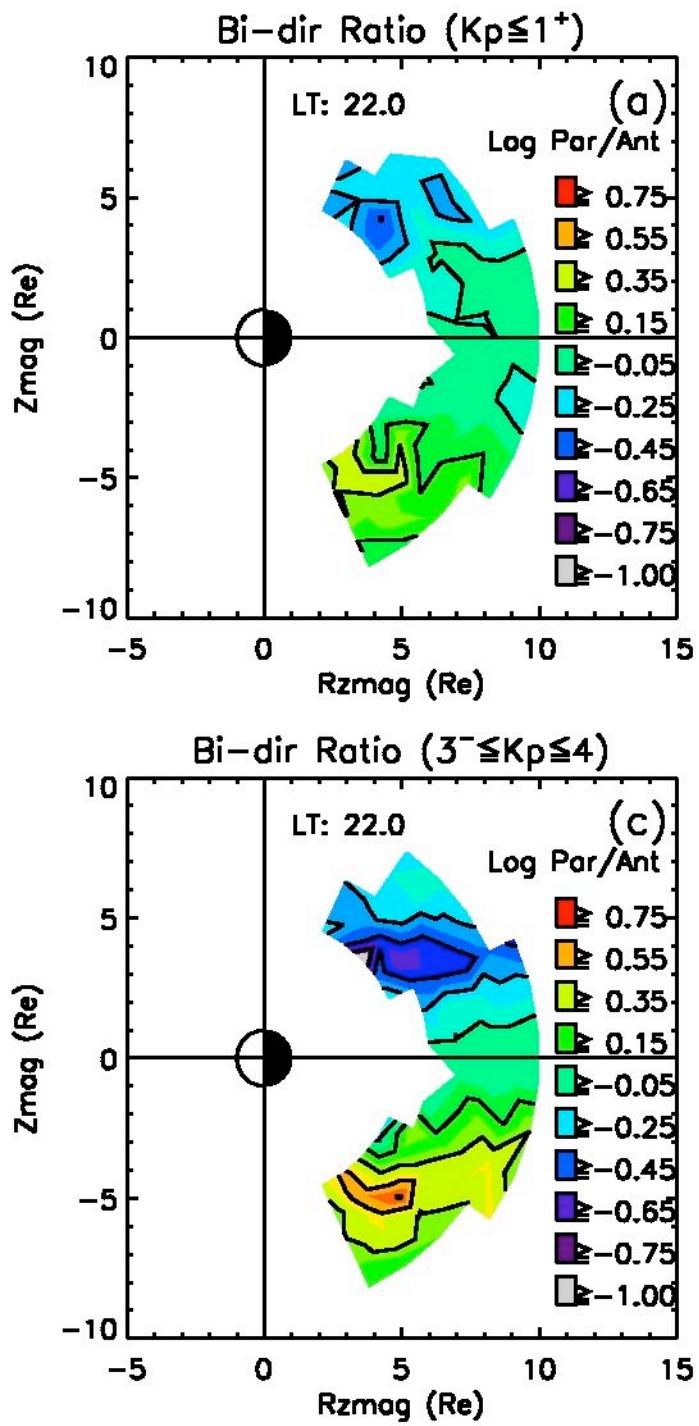
22LT  
Density  
vs  
Kp



22LT  
Tpara/  
Tperp  
vs  
Kp

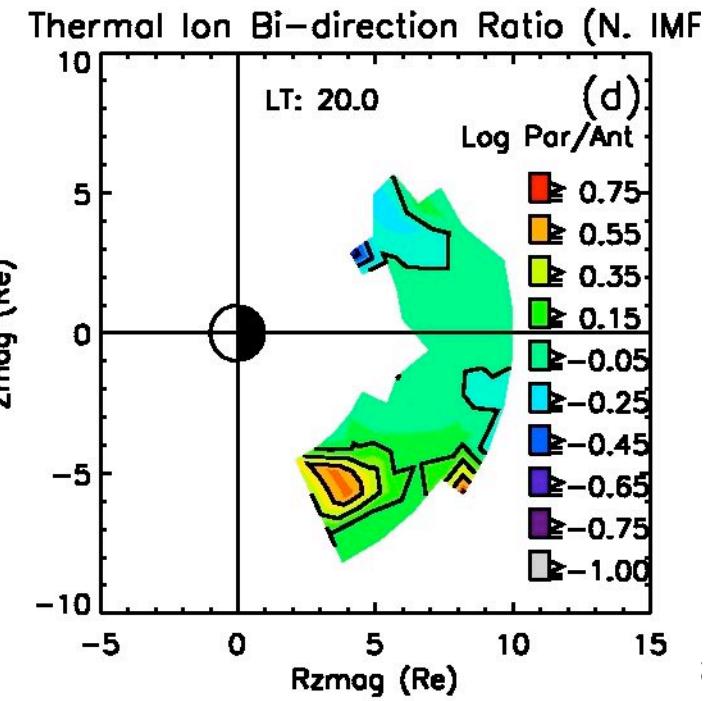
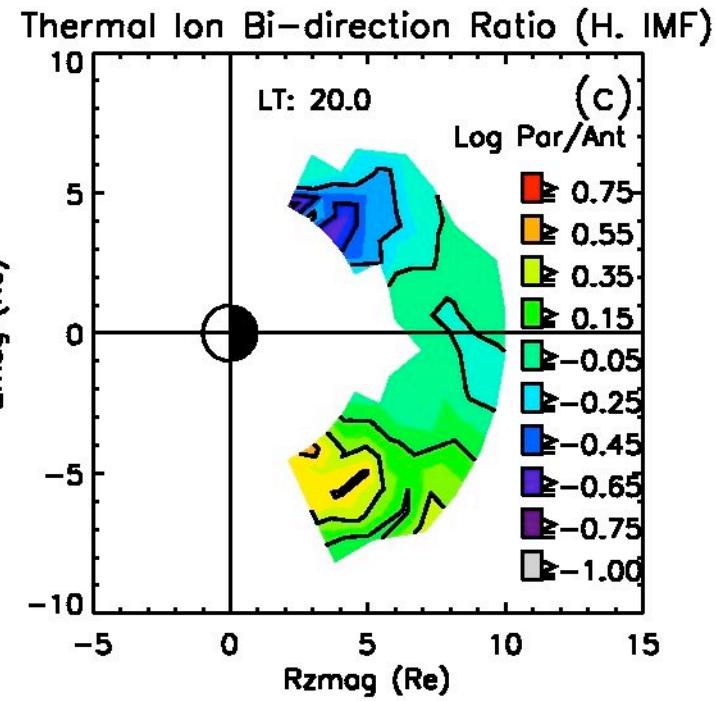
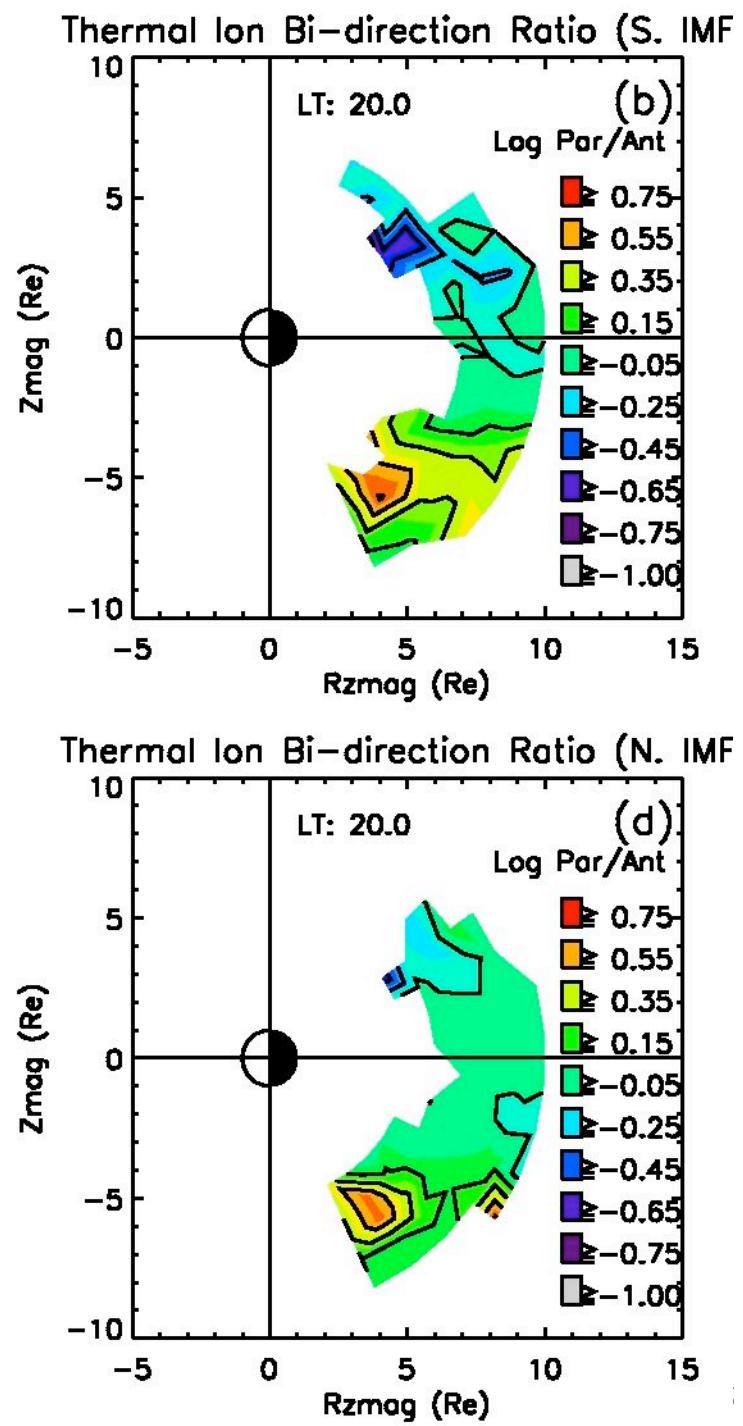
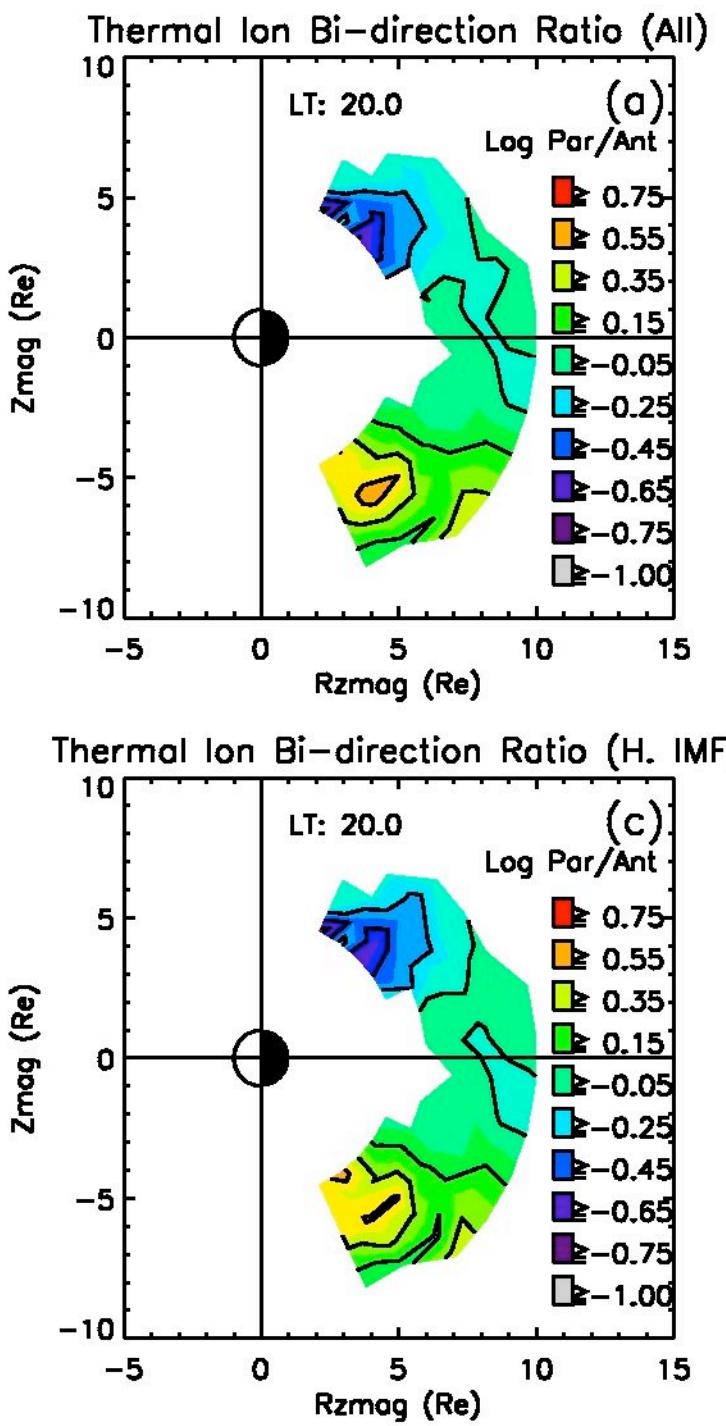


22LT  
Bi-Dir  
vs  
Kp

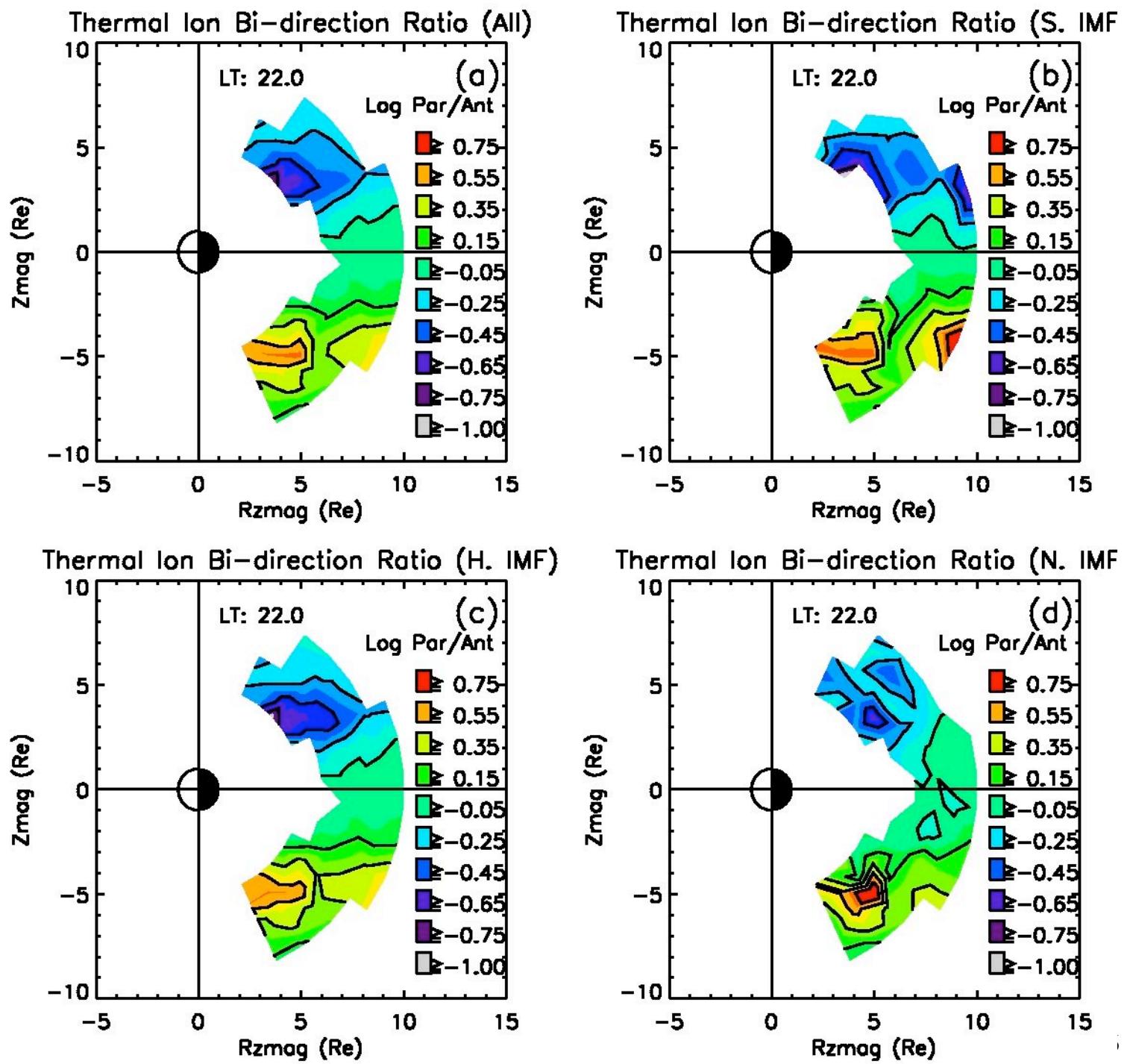


Bi-Dir  
IMF - LT dependent

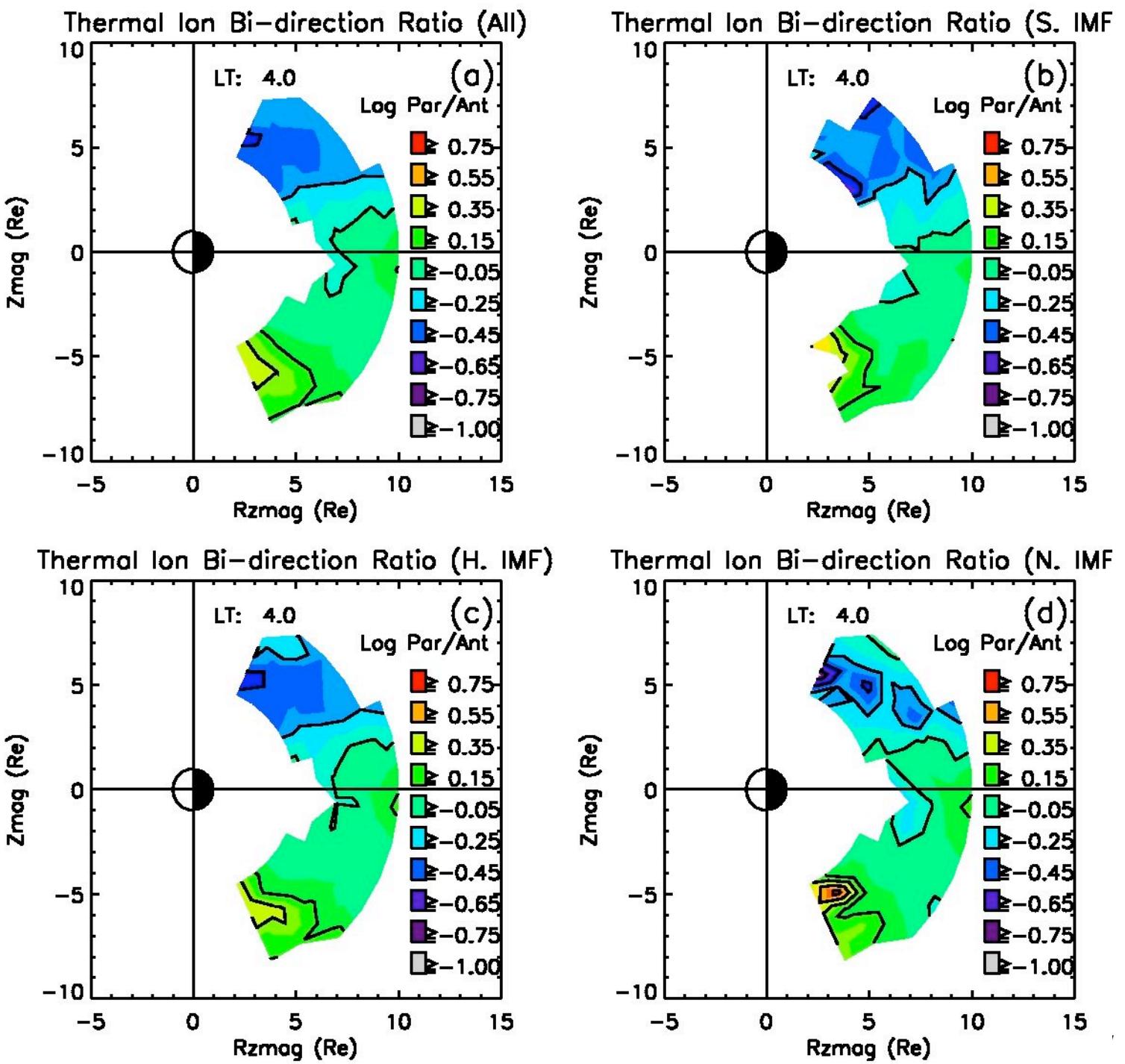
**LT20**  
**Bi-Dir**  
**IMF**  
**LT 20**



**LT22**  
**Bi-Dir**  
**IMF**  
**LT 22**

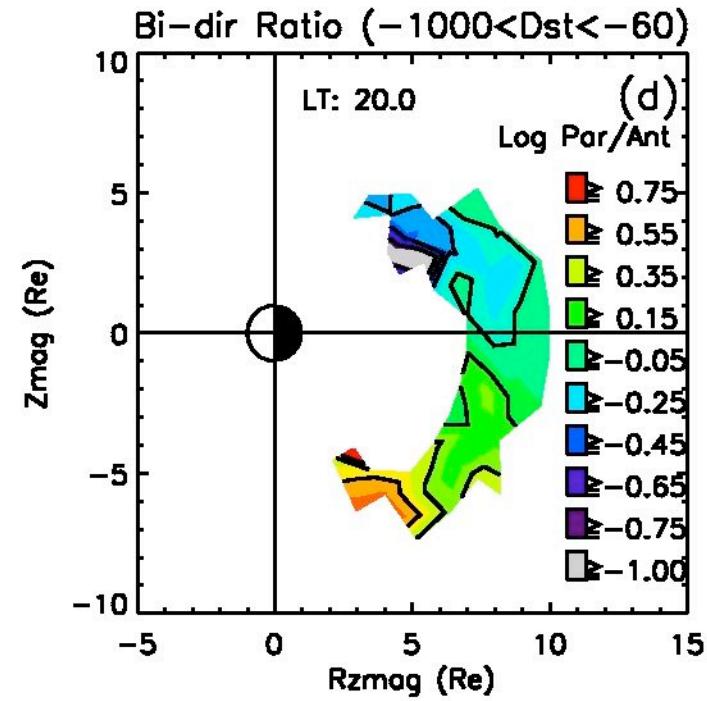
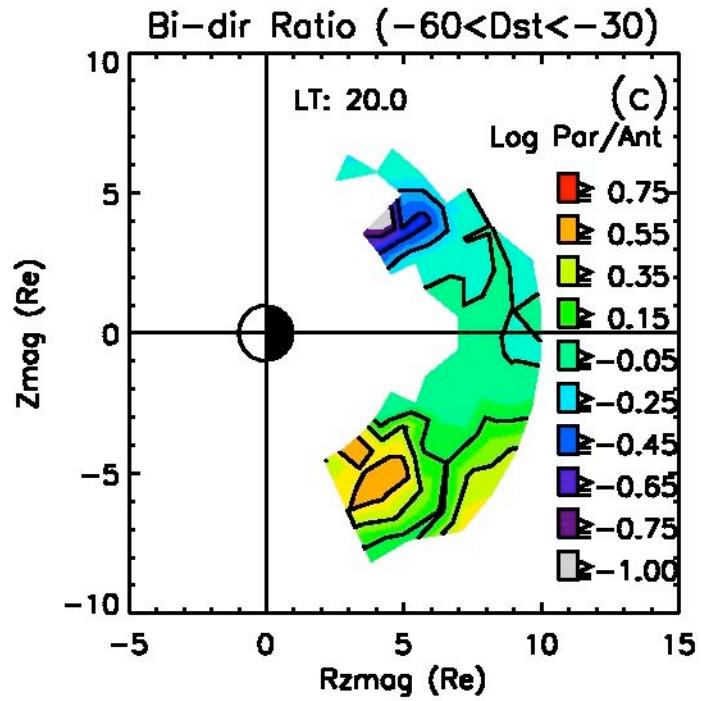
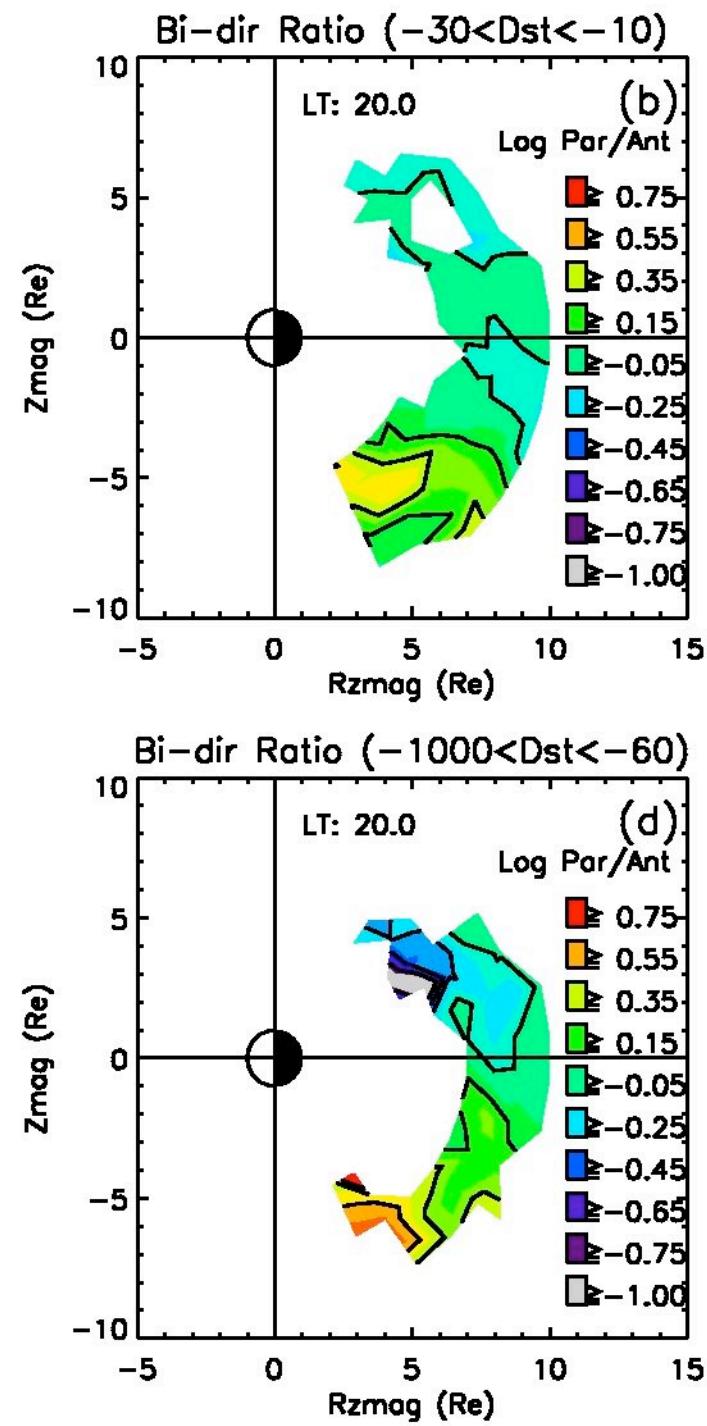
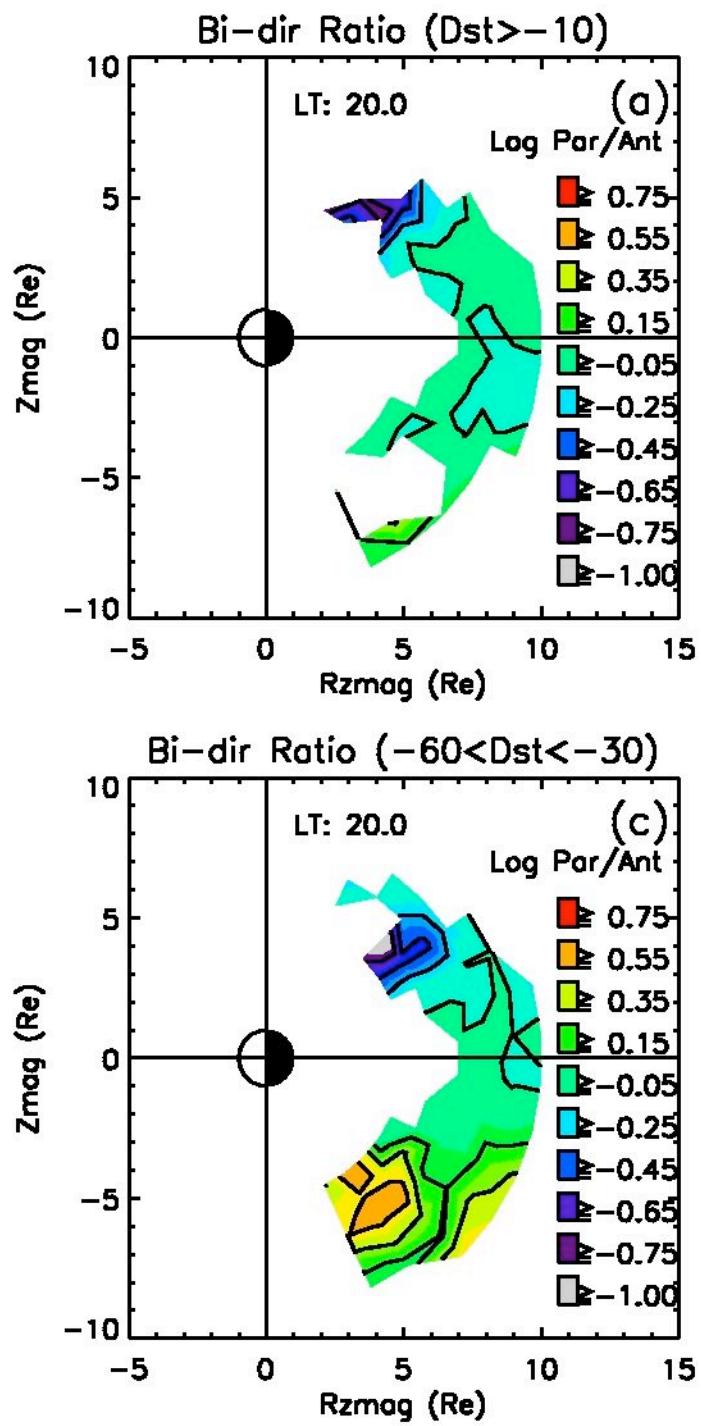


**LT04**  
Bi-Dir  
IMF  
LT 04

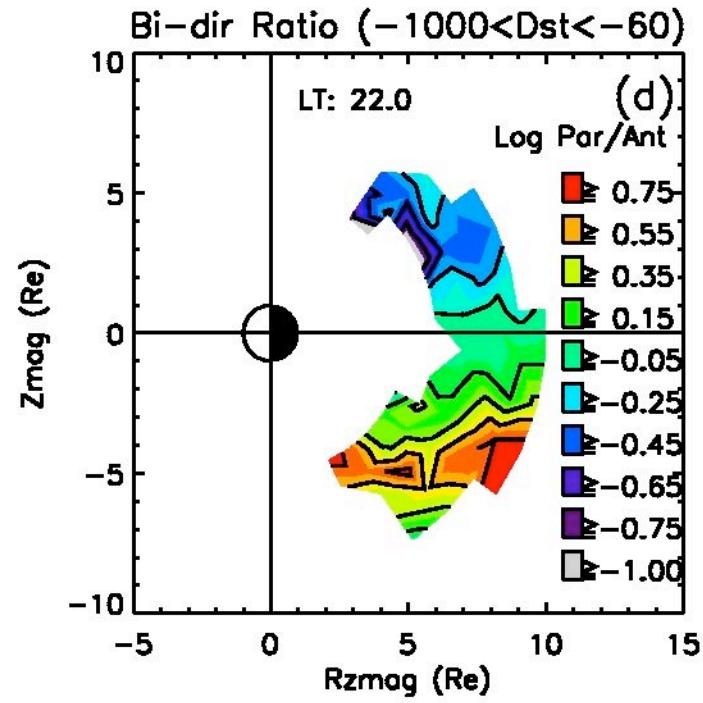
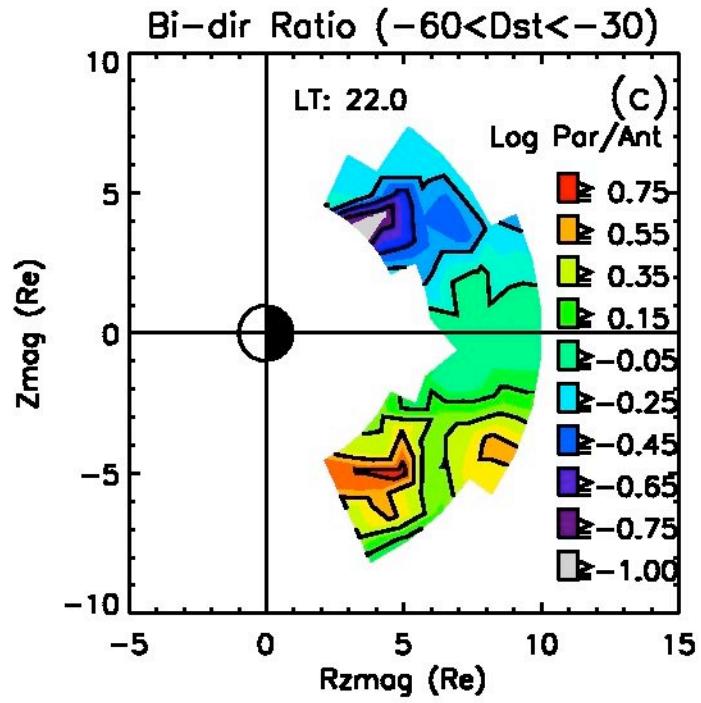
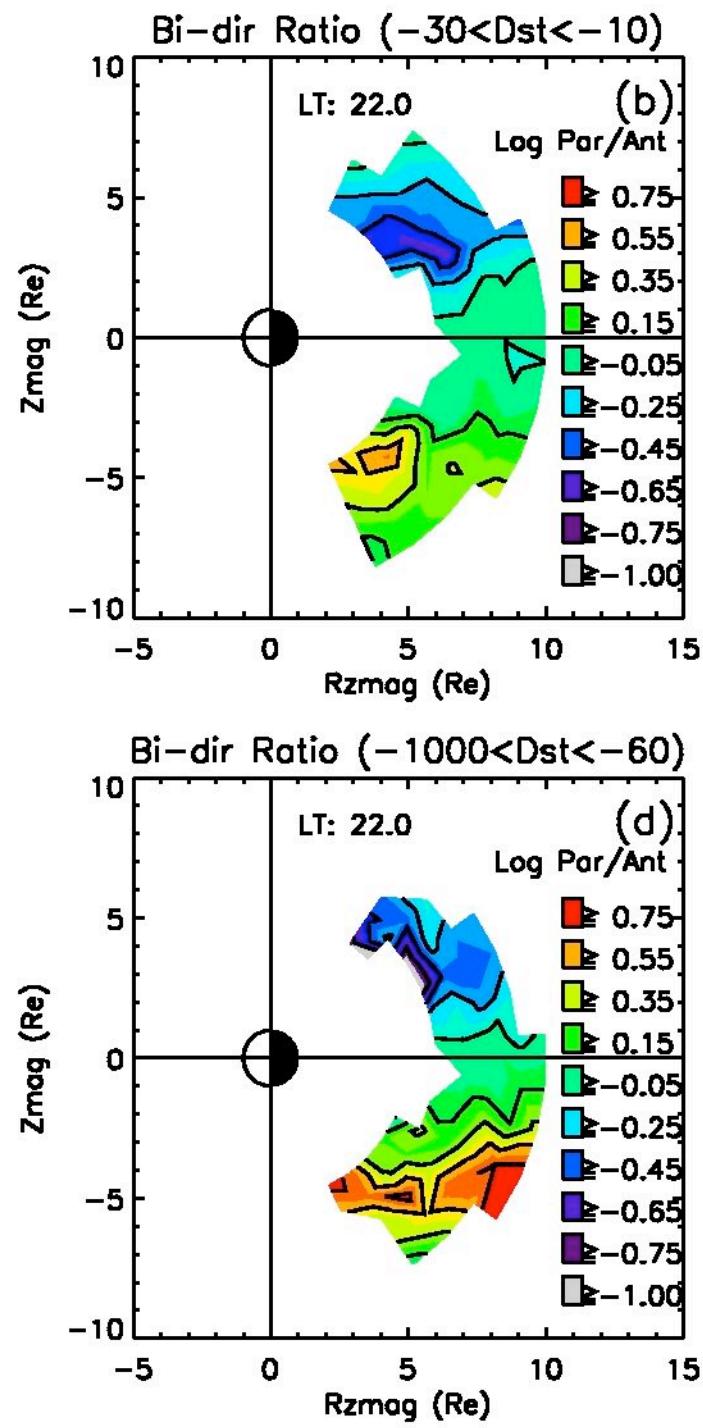
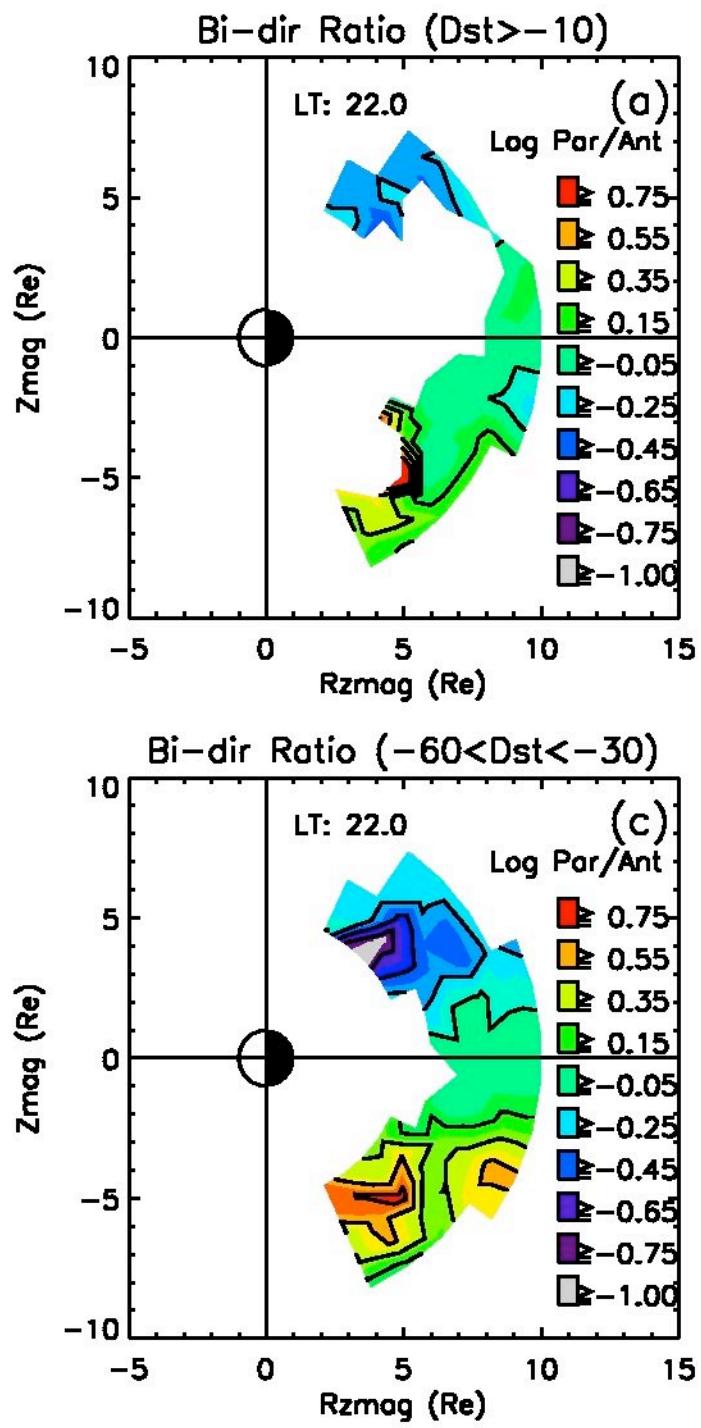


Bi-Dir  
Dst - LT dependent

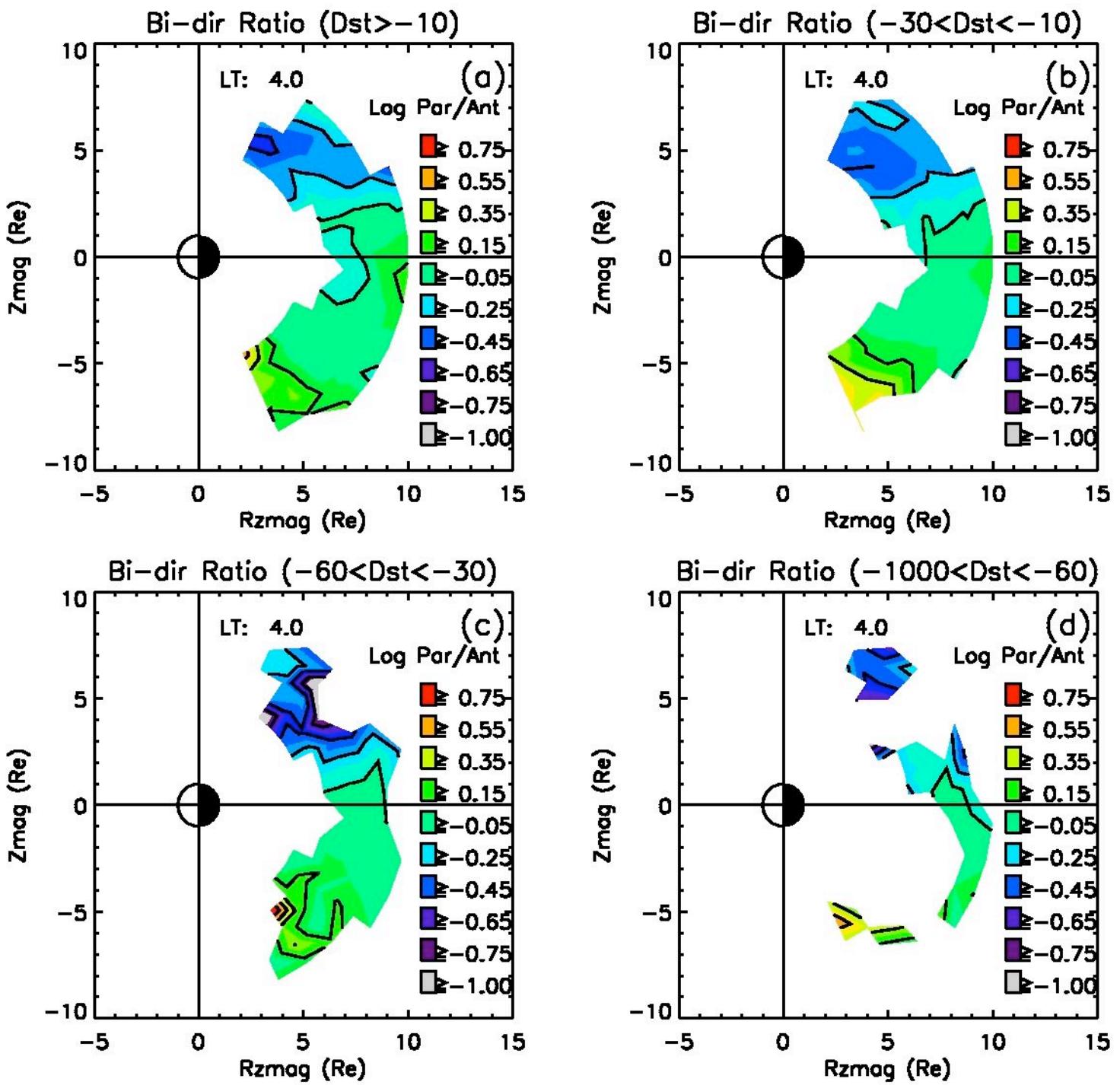
LT20  
Bi-Dir  
Dst  
LT 20



LT22  
Bi-Dir  
Dst  
LT 22



**LT04**  
**Bi-Dir**  
**Dst**  
**LT 04**



# Conclusions

- Persistent high latitude ionospheric ion outflows:
  - northern and southern hemispheres
  - all nightside LT, peak near midnight
- Alfvén speeds lower than CW: 50-500km/s
- Dawn-dusk asymmetries subtle
  - $T_{\text{para}}/T_{\text{perp}}$  favors  $T_{\text{para}}$  on dawn side
- Outer region more anisotropic than inner region
  - Inner, higher density for quiet conditions
  - Stronger flow for active  $K_p$ ,  $Dst$
  - Weak IMF effect
- Future work: continue to slice/dice/correlate dataset